US009085869B2

(12) **United States Patent**
Faivre

(10) **Patent No.: US 9,085,869 B2**
(45) **Date of Patent: Jul. 21, 2015**

(54) **LOADER WITH ACTUATING DEVICE ENTIRELY DISPOSED IN LOADER BOOM CAVITY**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 106 days.

(21) Appl. No.: **14/045,240**

(22) Filed: **Oct. 3, 2013**

(65) **Prior Publication Data**

US 2014/0119872 A1 May 1, 2014

(30) **Foreign Application Priority Data**

Oct. 30, 2012 (DE) 10 2012 021 191

(51) **Int. Cl.**

E02F 3/84	(2006.01)
E02F 9/00	(2006.01)
E02F 3/34	(2006.01)
E02F 3/43	(2006.01)
E02F 9/26	(2006.01)

(52) **U.S. Cl.**

CPC ***E02F 9/006*** (2013.01); ***E02F 3/3408*** (2013.01); ***E02F 3/431*** (2013.01); ***E02F 3/845*** (2013.01); ***E02F 9/264*** (2013.01)

(58) **Field of Classification Search**

CPC E02F 3/845; E02F 9/264
USPC ..... 414/698; 116/309, DIG. 21
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2006/0085116	A1 *	4/2006	Suzuki et al.	701/50
2014/0119870	A1 *	5/2014	Martinez et al.	414/728

FOREIGN PATENT DOCUMENTS

CA	2635148	A1	12/2008
DE	102007029795	A1	1/2009
JP	01090324	A *	4/1989
JP	H0312948	U	2/1991
JP	03194637	A *	8/1991
JP	06102905	A *	4/1994
JP	06228989	A *	8/1994
JP	H06102905	B2	12/1994
JP	H072553	U	1/1995
JP	2000054423	A *	2/2000
JP	20000054423	A	2/2000
JP	2000170218	A *	6/2000
JP	3194637	B2	7/2001
JP	2004278288	A *	10/2004

(Continued)

OTHER PUBLICATIONS

Eurasian Search Report, dated Dec. 27, 2013 (3 pages).

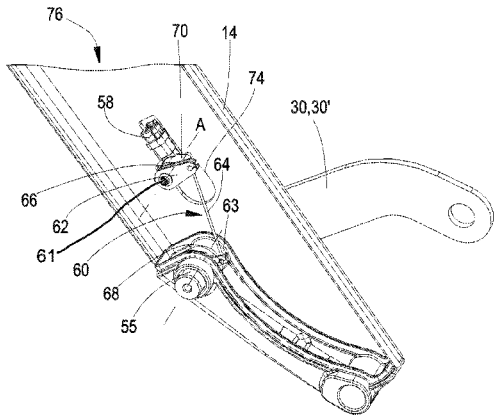
(Continued)

Primary Examiner — Gerald McClain

(57) **ABSTRACT**

A loader includes a tool carrier arranged on a loader boom. The tool carrier is connected at a first pivot point to the loader boom and at a second pivot point to a pivot linkage. The pivot linkage has first and second links which are pivotably connected to one another at a first link point. The first link is pivotably connected at a second link point to the loader boom, and the second link is pivotably connected at a second link point at the second pivot point to the tool carrier. A sensor senses a pivot angle between the tool carrier and loader boom. The sensor is positioned in a cavity on the loader. An actuating device is connected to the sensor.

3 Claims, 6 Drawing Sheets



(56) **References Cited**

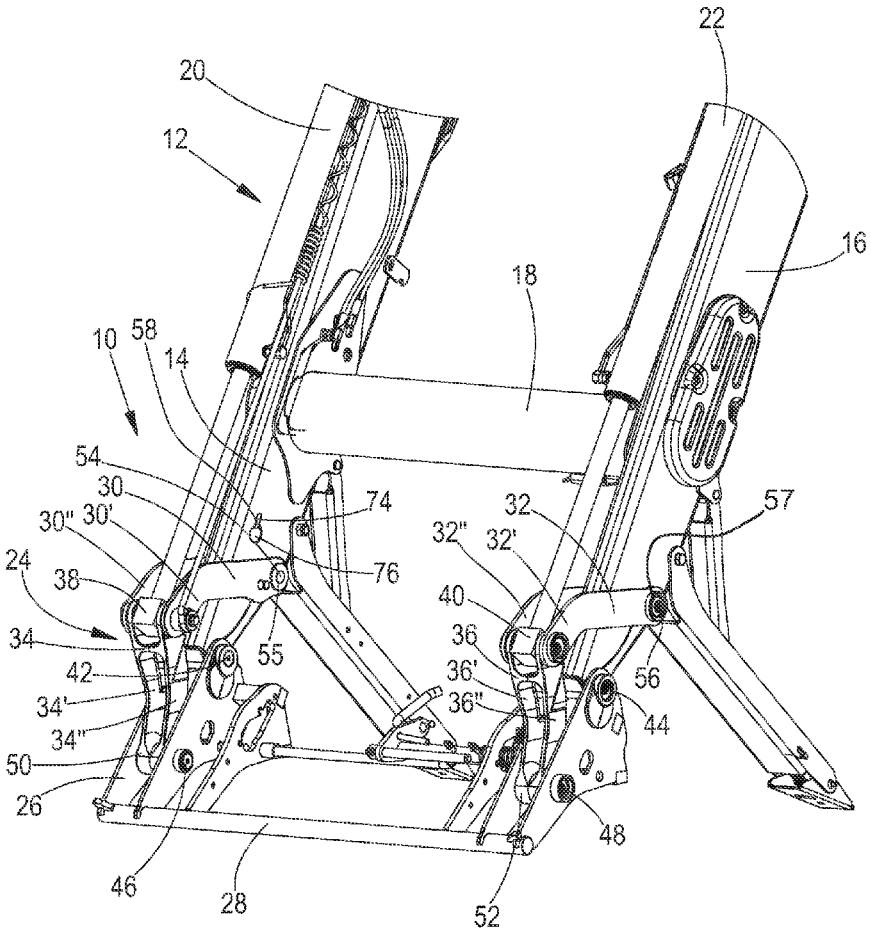
FOREIGN PATENT DOCUMENTS

JP	2007063820	A *	3/2007
JP	2009052287	A *	3/2009
RU	2009295	C1	3/1994
SU	789377	A	11/1980
WO	2007009207	A1	1/2007

OTHER PUBLICATIONS

European Search Report, dated Feb. 24, 2014 (9 pages).
German Office Action, dated Sep. 17, 2013 (6 pages).

* cited by examiner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12
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76
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FIG. 1

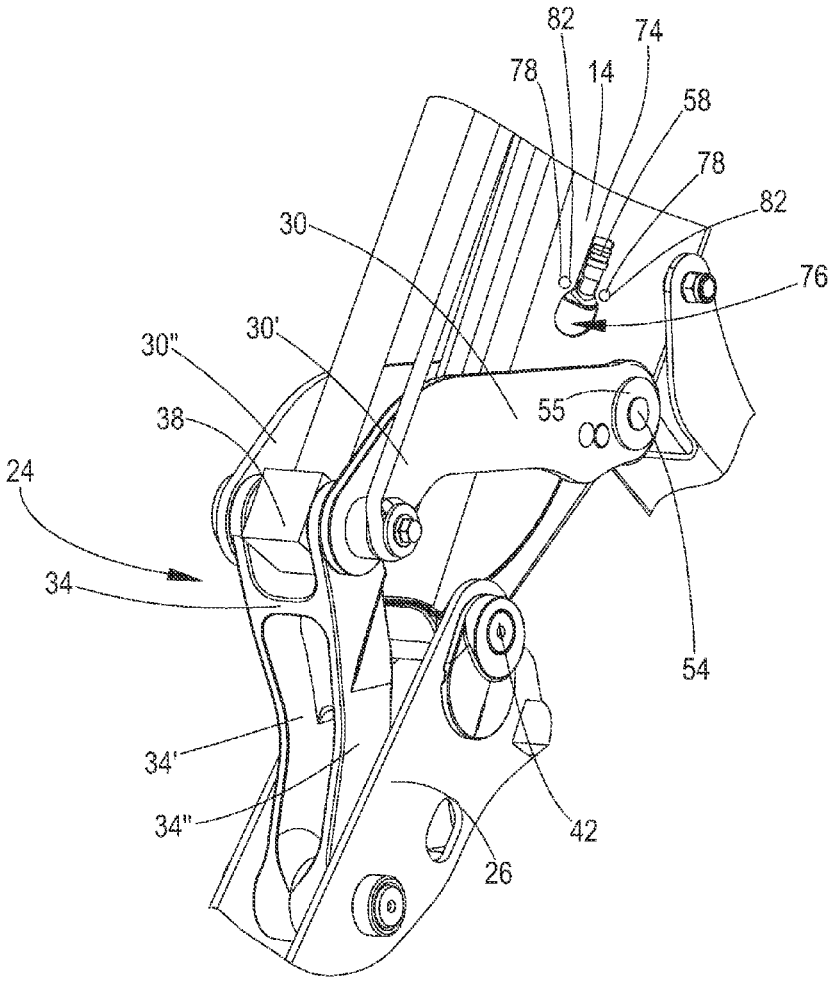

FIG. 2

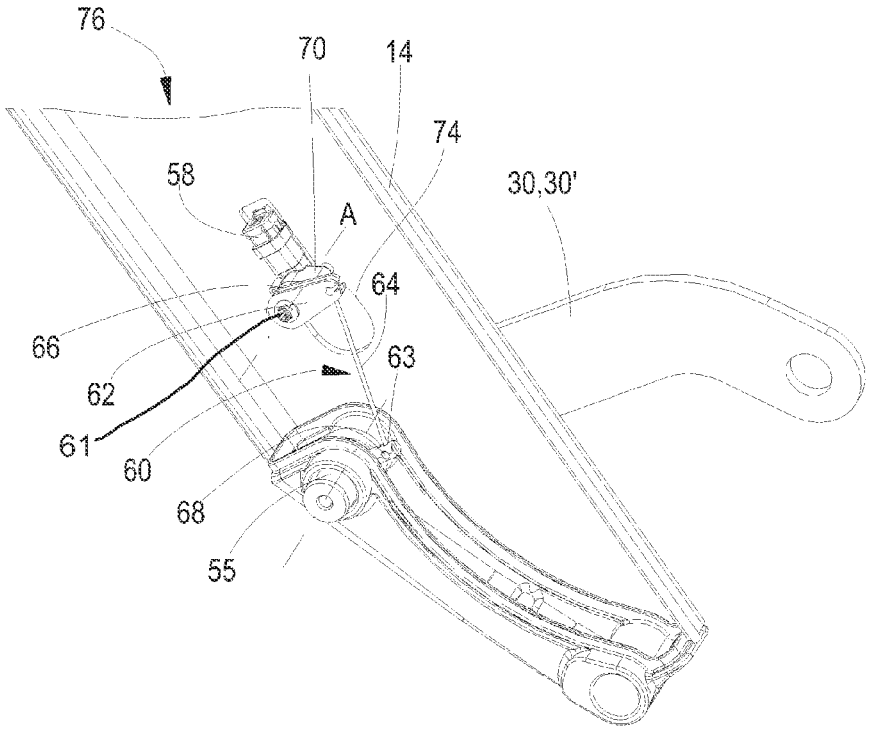

FIG. 3

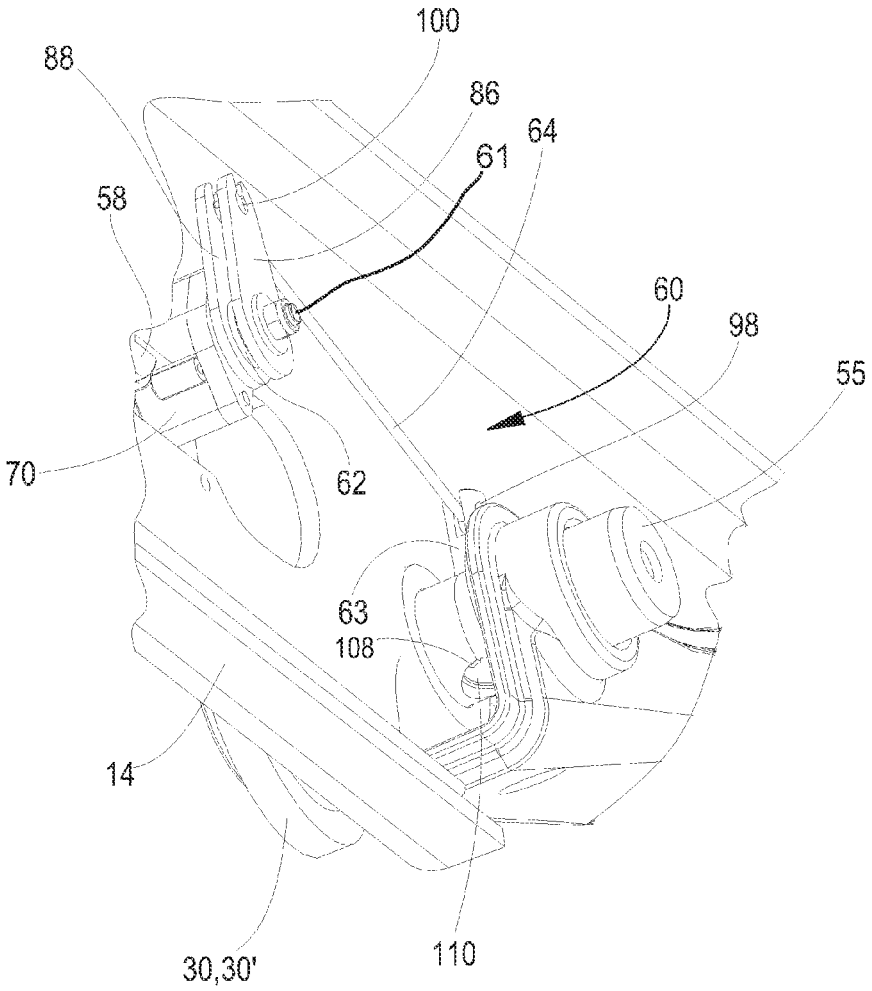

FIG. 4

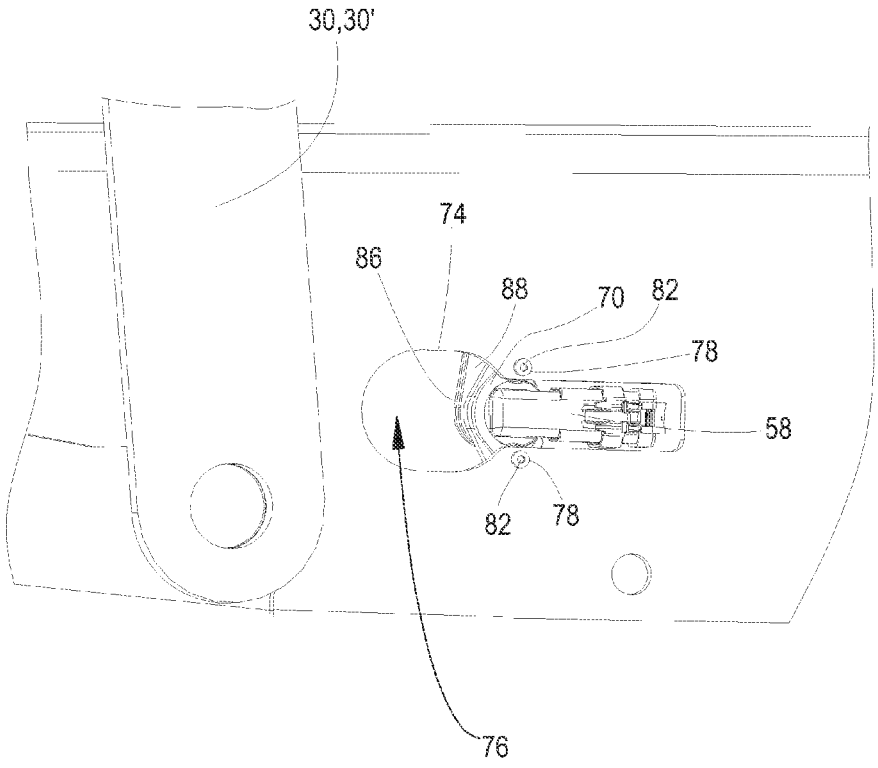

FIG. 5

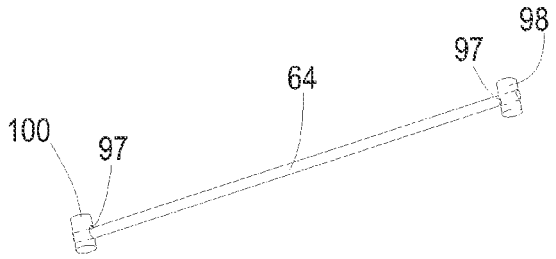

FIG. 6

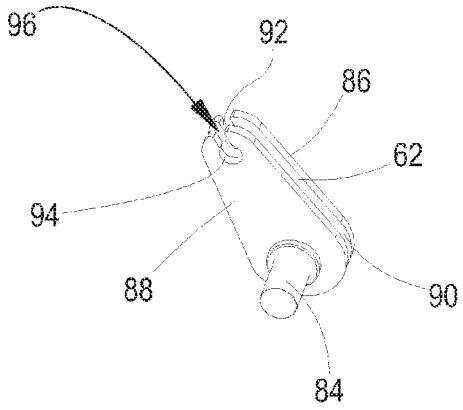

FIG. 7

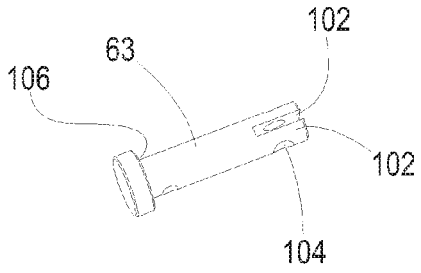

FIG. 8

LOADER WITH ACTUATING DEVICE ENTIRELY DISPOSED IN LOADER BOOM CAVITY

FIELD

The present disclosure relates to a loader having a tool carrier arranged on a loader boom.

BACKGROUND

Loaders, such as for example front loaders, wheeled loaders, telescopic loaders, rear loaders and the like, are known. It is also known for such loaders to be equipped with a sensor device which senses a pivot angle of a tool carrier or tool arranged on the loader, wherein the pivot angle indicates a pivoting position of the tool carrier in particular relative to a loader boom or a jib of the loader. The arrangement of a sensor device on the loader is often difficult or cumbersome because the sensor may be subjected to considerable loads, and in particular must withstand contamination and damage caused by load material and must be of correspondingly robust design or positioned in a protected manner. For example, magnetostrictive sensors are arranged directly on a lifting cylinder of the loader, to measure the stroke of the cylinder and determine the pivot angle at the tool. Magnetostrictive sensors are generally cumbersome to install and are also expensive. Alternatively, it is known to arrange rotational angle or rotation sensors on the loader, for example on the loader boom, on the tool carrier or on the pivot linkage of the loader. Here, there is the problem that additional protection must be provided for the sensor, for example by means of a robust cover. Such a cover may restrict a view of the tool, requires additional assembly and is costly.

SUMMARY

According to an aspect of the present disclosure, a front loader includes a sensor which is positioned in a cavity on the loader, and an actuating device is provided which is connected to the sensor and which extends in the cavity and which is connected to a pivot pin, arranged at the second link point, of the first link. The pivot pin is connected rotationally conjointly to the first link. Because the sensor is arranged in a cavity on the loader, the sensor is protected against external influences, or automatically covered, so that external objects cannot contact the sensor. Furthermore, assembly is simple because no additional covers are required. Preferably, the cavity is close to the pivot linkage, so that the actuating device can be of compact design, and a pivoting movement directly at the tool carrier or at the pivot linkage can be sensed. In this way, inaccuracies are avoided, and error tolerances can be kept small. The sensor may, for example, be a magnetic, potentiometric or optical rotational angle sensor or rotary sensor or rotation sensor.

The cavity may be formed in the loader boom, for example close to the pivot linkage. It is thus possible for the loader boom or a jib to be hollow, so that the opening is formed as a cutout in a hollow wall. Through corresponding positioning and design of the opening, assembly is also made simple and uncomplicated. A cable arrangement for the sensor may also be guided through the interior of the hollow profile, thus providing protection for the sensor and for the cable arrangement against externally-induced damage. Alternatively, the sensor could also be positioned in a cavity of the pivot linkage or of the tool carrier, for example between two spaced-part links or support plates, wherein the opening is formed either by a cutout on the links or support plates or by the spacing of the links or support plates to one another.

The actuating device includes a rotary axle which is connected to the sensor, a first rotary lever which is connected rotationally conjointly to the axle, a second rotary lever which is connected rotationally conjointly to the pivot pin, and a control arm. The control arm pivotably connects the first rotary lever to the second rotary lever so that a rotational movement of the pivot pin is transmitted by the second rotary lever via the control arm to the first rotary lever and thus to the sensor. Here, the axle serves as a rotational angle encoder or transmitter for the sensor and may be connected to the sensor directly or indirectly for example by means of a rotational transmission means. The first rotary lever is a rigid connecting arm which extends radially. The first rotary lever thus transmits a movement imparted at the first rotary lever directly to the rotary axle of the sensor. The second rotary lever is a rigid connecting arm extends radially with respect to the axle. The second rotary lever thus transmits a rotational movement performed at the pivot pin to the control arm. By means of a control arm, which is a pivotable link or a connecting rod, a rotation of the pivot pin is consequently converted into a rotational movement of the rotary axle at the sensor.

The second rotary lever may be a transverse pin which extends through a transverse bore in the pivot pin. The transverse pin may for example be guided through the transverse bore and held in the transverse bore by a securing means, for example a circlip. The transverse pin may however also comprise a thread by means of which it is screwed into a thread of the transverse bore.

According to the invention, the loader may be a front loader, wheeled loader, telescopic loader or rear loader. The loader boom is a loader boom of a front loader or wheeled loader, or as a jib of a telescopic loader or rear loader. Front loaders and rear loaders may be used as attachment units on agricultural tractors or construction machines. The expression "loader" is also intended to encompass other loader-like assemblies and machines which have a loader boom or a jib, for example construction machines such as diggers, bulldozers or forestry machines for deforestation of woodland, or if appropriate also cranes.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective front view of a loader for the front region of a loader boom;

FIG. **2** is an enlarged perspective side view of a pivot linkage portion of the loader of FIG. **1**;

FIG. **3** is a perspective front side view of the outer, partially open side of the loader boom of FIG. **2**;

FIG. **4** is a perspective bottom rear side view of the loader boom of FIG. **3**;

FIG. **5** is an enlarged perspective side view of the inner side the loader boom of FIG. **2**;

FIG. **6** is a perspective side view of a control arm of an actuating device for the sensor of FIG. **5**;

FIG. **7** is a perspective side view of a first rotary lever of the actuating device of FIG. **6**; and

FIG. **8** is a perspective side view of a second rotary lever of the actuating device of FIG. **6**.

DETAILED DESCRIPTION OF THE DRAWINGS

FIG. **1** shows a part of a loader **10** in the form of a front loader. The front loader is operated in combination with a carrier vehicle, for example an agricultural tractor (not

shown), and is normally used in the field of agriculture and construction machinery. In the case of a loader **10** being fixedly (non-detachably) mounted on a carrier vehicle, this is referred to as a wheeled loader, but within the context of this invention this is substantially equivalent to a carrier vehicle with a detachably mounted loader **10** (front loader).

The loader **10** comprises a loader boom **12** or jib. The loader boom **12** includes a first and a second boom part **14**, **16** which are guided parallel to one another and are connected to one another by means of a crossbeam **18**. The loader boom **12** or the jib may however also comprise only one boom part, such as may be the case for example in telescopic loaders, cranes, diggers or forestry machines.

The loader boom **12** also comprises a first and a second lifting cylinder **20**, **22**, to which is connected a pivot linkage **24** with a tool carrier **26** extending transversely with respect to the loader boom **12**. The tool carrier **26** may be equipped, via a tool receptacle **28**, with a tool (not shown). In the case of wheeled loaders, for example, fixedly installed tools in the form of a scoop may be used, such that a tool carrier **26** may be dispensed with and the pivot linkage **24** engages directly on the tool.

Referring to FIG. **2**, the pivot linkage **24** includes, at both sides of the loader boom **12**, that is to say on each boom part **14**, **16**, a first link **30**, **32** and a second link **34**, **36**, these being articulatedly connected to one another at a first link point **38**, **40**, wherein the lifting cylinders **20**, **22** engage on the first link point **38**, **40**. For dynamic and static reasons, the links **30**, **32**, **34**, **36** are normally flat members spaced apart from one another in pairs, so that, at both sides of the loader boom **12**, the pivot linkage **20** comprises a flat member pair **30'**, **30"**, **32'**, **32"**, **34'**, **34"** and **36'**, **36"** for each of the links **30**, **32**, **34**, **36**. The links **30**, **32**, **34**, **36** may however also be arranged as single-piece links **30**, **32**, **34**, **36** (flat member pairs **30'**, **30"**, **32'**, **32"**, **34'**, **34"** and **36'**, **36"** not arranged in pairs).

The tool carrier **26** has, at both sides, a first pivot point **42**, **44** at which it is pivotably connected in each case to a boom part **14**, **16** of the loader boom **12** (pivot point **42** on boom part **14**, pivot point **44** on boom part **16**). Furthermore, the tool carrier **26** has, at both sides, a second pivot point **46**, **48** at which it is connected to the second link **34**, **36** in each case at a second link point **50**, **52** thereof. At a second link point **54**, **56** of the first link **30**, **32**, said first link is pivotably connected via a pivot pin **55**, **57** to a boom part **14**, **16** of the loader boom **12**, wherein the pivot pin **55**, **57** is in each case rotationally conjoint with the first link **30**, **32**. With this arrangement, the tool carrier **26** can be tilted in a controlled manner with defined kinematics by the stated lifting cylinders **20**, **22** via the first and second links **30**, **32**, **34**, **36** or via the pivot linkage **24**, wherein a certain tilt angle of the tool carrier **26** is associated with a defined pivoting movement of the first and second links **30**, **32**, **34**, **36** (see in particular FIG. **2**).

For sensing the pivot angle or tilt angle of the tool carrier **26**, a sensor **58** is provided which is connected via an actuating device **60** to the pivot linkage **26**, in particular to the first link **30** or to the flat profile **30'** thereof. The sensor **58** senses the pivot angle relative to the loader boom **12**.

The actuating device **60** includes a rotary axle **61** which defines an axis A, a first rotary lever **62**, a second rotary lever **63** and a control arm **64**. The first rotary lever is connected rotationally conjointly to the rotary axle **61**, so that, by actuation of the first rotary lever **62**, the axle **61** is rotated and the sensor **58** is actuated. A signal from the sensor may be is transmitted by a known method, for example by cable or radio (not shown) to a data processor or to a data display (not shown) and is displayed. The axle **61** may be connected directly to the sensor **58** as illustrated, or the axle may be connected to the sensor **58** by a transmission, such as a gearwheel. The control arm **64** is pivotably connected at a joint **66** to the first rotary lever **62**. Furthermore, the control arm **64** is pivotably coupled at joint **68** to the second rotary lever **63**. The second rotary lever **63** is rotationally conjointly connected to the pivot pin **55**, which in turn is rotationally conjointly connected to the first link **30**, **32**.

The sensor **58** is mounted on a mounting plate **70**. The loader boom **12** has, on its inner side on the boom part **14** in the region of the pivot linkage **24**, an opening **74** which, in the wall of the loader boom **12** or of the boom part **14**, forms an access to a cavity **76** in the loader boom **12** or of the boom part **14**. The opening **74** is keyhole-shaped or formed as a slotted cutout and has fastening bores **78** on its long sides. The opening **74** may alternatively also be rectangular, as a rectangular cutout. The fastening bores **78** are formed as through bores.

The mounting plate **70** is of oval shape, wherein the dimensions of the mounting plate are selected such that the mounting plate **70** can be inserted through the opening **74**. On the mounting plate **70** there are provided corresponding fastening bores which overlap the fastening bores **78** at the opening **74**. The fastening bores on the mounting plate **70** are equipped with a thread, so that the mounting plate **70** can be fastened to the wall of the loader boom **12**, or of the boom part **14**, by means of threaded screws **82** (see FIGS. **6** and **10**).

FIGS. **6** to **8** show the actuating device **60** separated into its individual parts, wherein the actuating device includes the first rotary lever **62**, the control arm **64** and the second rotary lever **63**. The first rotary lever **62** is connected to the sensor by means of a rotary axle **84** formed on the rotary lever **62**. The first rotary lever **62** includes two lever discs **86**, **88**, between which is formed a gap **90**. Furthermore, on both holding discs **86**, **88**, at one point on the circumference, there are formed recesses **92**, **94** which constitute a pin receptacle **96**.

The control arm **64** is a rigid bar or rod and has a thread **97** on both of its ends. Furthermore, to both ends of the control arm **64**, there are fastened pins **98**, **100** which are provided with threaded bores transversely with respect to the control arm **64**.

The second rotary lever **63** is a bolt or pin and has, on one end thereof, a fork **102** through which a bore **104** extends, such that a gap **106** formed between the fork **102** extends transversely with respect to the bore **104**. At its other end, the second rotary lever has a shoulder **106**.

On the pivot pin **55**, too, there is provided a transverse bore **108** which is provided with a shoulder **110** corresponding to the shoulder **106**. The diameter of the transverse bore **108** corresponds substantially to the small diameter of the second rotary lever **63**. Furthermore, there is formed in the transverse bore **108** an annular groove into which a circlip **110** is inserted (see FIG. **4**).

Mounting of the actuating device **60** and of the sensor **58** onto the loading boom **12** takes place in such a way that, firstly, the mounting plate **70** with sensor **58** and first rotary lever **62** is inserted through the opening **74** into the cavity **76**, and the mounting plate **70** is positioned transversely with respect to the opening **74**, such that the fastening bores **78** (and those in the mounting plate) overlap and the mounting plate **70** bridges the opening in terms of width (in the transverse direction). By means of the threaded screws **82**, the mounting plate **70** is fastened to the wall of the loader boom **12** or of the boom part **14**, wherein the threaded screw heads are situated outside the cavity **76**, on the outer side of the wall, and the mounting plate **70** with sensor **58** and first rotary lever **62** are situated within the cavity **76**, on the inner side of the wall. Next, the remaining parts of the actuating device **60** are

pre-mounted by virtue of the pin **98** of the control arm **64** being inserted into the bore **104** of the second rotary lever. Subsequently, the control arm **64** is screwed to the pin **98**, such that the control arm **64** is pivotably mounted in the fork **102**. The second pin **100** is likewise connected to the control arm **64**. The control arm **64** and the pins **98**, **100** fastened thereto, and also the second rotary lever **63**, are then inserted through a mounting opening **112** below the pivot pin **55** (see FIG. **4**) and passed through the transverse bore **108** of the pivot pin **55**. After insertion into the transverse bore **108**, the circlip **110** is inserted, such that the second rotary lever **63** is secured against axial displacement by the circlip **110** and shoulder **106**. Subsequently, via the opening **74**, the pin **100** of the control arm **64** is, from the outside, placed in connection with the recesses **92**, **94** of the lever discs **86**, **88**, such that the control arm **62** is pivotably mounted by means of the pin **100** and the gap **90** between the lever discs **86**, **88**.

The sensor **58** is then situated in the cavity **76** of the loader boom **12** (see FIGS. **4** and **5**) and is protected against any external influences by the wall of the loader boom **12**. The same applies to the actuating device **60** of the sensor **58** and a cable arrangement of the sensor **58**, which can be easily passed through the cavity **76**.

As a result of connection of the first rotary lever **62** to the pivot pin **55** or to the first link **30**, which is connected rotationally conjointly to the pivot pin **55**, of the pivot linkage, the actuating device **60** is placed in connection with the pivot linkage **24**. A pivoting movement of the tool carrier **26** or of a tool fastened thereto is thus transmitted by the first link **30** of the pivot linkage **24** to the second rotary lever **63**, from there to the control arm **64**, and from there to the first rotary lever **62**. The first rotary lever then rotates axle **61** and generates a corresponding pivot angle signal at the sensor **58**. Here, the pivot angle signal represents a pivot angle or a change in the pivot angle between the tool carrier **26** and loader boom **12**. As a result of the positioning of the sensor **58** close to the pivot linkage **24**, measurement errors are kept small. Furthermore, the actuating device **60** can be of compact form with a small design, such that overall, in addition to the protection of the sensor **58** provided by the wall at the cavity **76**, a small engagement surface for external objects is provided, and mounting can be realised in a simple manner.

While the disclosure has been illustrated and described in detail in the drawings and foregoing description, such illustration and description is to be considered as exemplary and not restrictive in character, it being understood that illustrative embodiments have been shown and described and that all changes and modifications that come within the spirit of the disclosure are desired to be protected. It will be noted that alternative embodiments of the present disclosure may not include all of the features described yet still benefit from at least some of the advantages of such features. Those of ordinary skill in the art may readily devise their own implementations that incorporate one or more of the features of the present disclosure and fall within the spirit and scope of the present invention as defined by the appended claims.

The invention claimed is:

1. A loader having a tool carrier arranged on a loader boom, wherein:

the tool carrier is connected at a first pivot point to the loader boom and at a second pivot point to a pivot linkage;

the pivot linkage comprises a first and a second link which are pivotably connected to one another at a first link point;

the first link is pivotably connected at a second link point to the loader boom, and the second link is pivotably connected at a second link point at the second pivot point to the tool carrier; and

a sensor senses a pivot angle between the tool carrier and the loader boom, the sensor being positioned in a cavity on the loader, and

an actuating device is connected to the sensor, entirely disposed in the cavity and is connected to a pivot pin, the pivot pin being arranged at the second link point, wherein the pivot pin is connected rotationally conjointly to the first link,

wherein the cavity is disposed in the loader boom.

2. The loader of claim **1**, wherein:

the actuating device comprises a rotary axle which is connected to the sensor, a first lever which is connected rotationally conjointly to the axle, a second lever which is connected rotationally conjointly to the pivot pin, and a control arm, wherein the control arm pivotably connects the first lever to the second lever so that a rotational movement of the pivot pin is transmitted by the second rotary lever via the control arm to the first rotary lever and thus to the sensor.

3. The loader of claim **2**, wherein:

the second rotary lever is a transverse pin which extends through a transverse bore in the pivot pin.

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